

Axiom Wheat Breeder's Genotyping Array

High-throughput genotyping for elite wheat lines

The Applied Biosystems™ Axiom™ Wheat Breeder's Genotyping Array is a cost-effective and highly efficient system for screening large numbers of wheat lines. The array was designed through our Expert Design Program in collaboration with Professor Keith Edwards and Dr. Sacha Allen from the Cereal Functional Genomics Group at the School of Biological Sciences, University of Bristol, funded by the Biotechnology and Biosciences Research Council (BBSRC) in the UK. The Axiom Wheat Breeder's Genotyping Array is ideally suited for high-throughput screening in wheat breeding programs and was described by Dr. Gary Barker from the University of Bristol at the Plant and Animal Genome Conference in 2014 [1,2].

The array interrogates prevalidated SNPs that were carefully selected by the breeders and are polymorphic in elite wheat lines from European and North American varieties. The array offers coverage of markers spaced across the wheat genome. The markers are a subset of the markers on the Applied Biosystems™ Wheat HD Genotyping Arrays, which contain 817,000 SNPs. The probes were selected based on their genetic map location, diversity level, and usefulness in a range of elite global germplasm.

Highlights

Content:

- 35,143 markers spaced across the A, B, and D genomes of which 35,042 are physically and/or genetically mapped to each of the 21 wheat chromosomes:
 - A genome: 10,819 markers
 - B genome: 12,932 markers
 - D genome: 11,291 markers
- Markers have been previously tested on the Applied Biosystems™ Axiom™ genotyping platform and were selected for being highly polymorphic
- Inclusion of codominant SNPs, ensuring clear differentiation between homozygotes and heterozygotes [3]
- SNPs exhibit a range of polymorphism information content (PIC) scores (Figure 1)

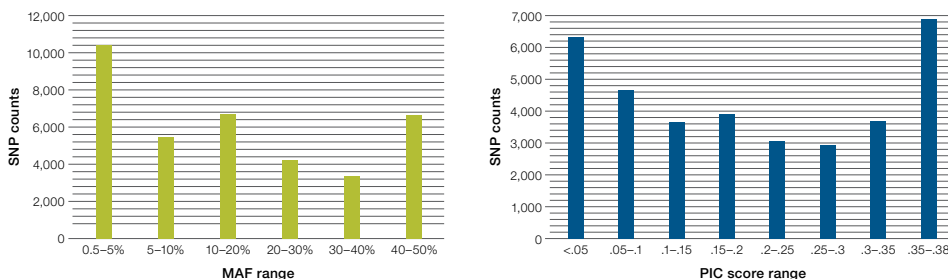


Figure 1. Minor allele frequency (MAF) and PIC ranges represented on the array.

Diversity:

- SNP discovery and verification were completed by using a diverse set of 140 elite wheat lines used by breeders
- Samples tested, representing hard and soft varieties, were provided by Syngenta, KWS, RAGT, and Limagrain

Applications

Molecular breeding:

- Genomic selection
- Marker-assisted selection
- Detection of introgressed genes
- Germplasm characterization and high-throughput screening

Polymorphic content

The polymorphic markers on the Axiom Wheat Breeder's Genotyping Array are searchable on the CerealsDB website (cerealsdb.uk.net). This is a database created by the Functional Genomics Group at the University of Bristol, UK, for the purpose of making SNP information available to the worldwide wheat community. It is updated regularly and contains:

- SNP statistics [4]: Data related to every SNP including map location, 120 bp flanking sequences, MAF, and PIC score
- Variety comparison [5]: Select two or more varieties of wheat to see the SNPs in common or SNPs that are different between them

SNP selection

The marker discovery was completed by high-coverage (48x) exome sequencing using a 132,000-feature NimbleGen™ capture array based on wheat cDNAs. Following marker discovery, 817,000 markers were screened on Axiom Wheat HD Genotyping Arrays. The 35,143 markers on the Axiom Wheat Breeder's Genotyping Array were selected from Axiom Wheat HD Genotyping Arrays using the following criteria:

- SNPs that were polymorphic in hexaploid varieties on elite lines
- Markers that were on contigs identified by the International Wheat Genome Sequencing Consortium (IWGSC)
- Markers that were genetically mapped were selected before selecting unmapped SNPs
- Markers were selected by prioritizing codominant markers (more likely to lie in coding regions), followed by partially codominant markers and dominant SNPs; markers that had the highest PIC score within the best-available dominance class were prioritized

A variety of wheat lines have been screened using the Axiom Wheat Breeder's Genotyping Array (Table 1).

Table 1. Lines screened using the Axiom Wheat Breeder's Genotyping Array.

Wheat lines							
Azzerti	Bacanora	Badger	Batis	Battalion	Beluga	Bergamo	Bermude
Biscay	Bobwhite	Boregar	Brompton	Bussard	Buster	Cadenza	Capelledesprez
Caphorn	Cellule	Charger	ChineseSpring	Claire	Cocoon	Cordiale	Cougar
Crusoe	Cubus	Dekan	Delphi	Dickens	Dinosor	Duxford	Einstein
Except	Exotic	Expert	Fabian	Fiorello	Gallant	Garcia	Gatsby
Glasgow	Gravitas	Gulliver	Hereford	Hereward	Highbury	Hobbit	Horatio
Humber	Invicta	JB_Diego	Julius	Koreli	KWS_Gator	KWS_Kielder	KWS_Podium
KWS_Santiago	KWS_Target	Laurier	Leeds	Longbow	Lynx	Malacca	Mercado
Moisson	Moulin	NIABParagon	Oakley	Opata	Option	Oratorio	Panorama
Paragon	Pavon76	Premio	Relay	Renan	Revelation	Rialto	Riband
Robigus	Rocky	Savannah	Shamrock	Shango	Skyfall	Soisson	Solstice
Spark	Tommi	Tremie	Tuerkis	Tuxedo	Viscount	Weebil	Xi19

References

1. LabTube interview with Gary Barker, University of Bristol.
<http://www.labtube.tv/playVideo.aspx?vid=161532>
2. PAG Presentation by Gary Barker, University of Bristol.
<https://www.youtube.com/watch?v=9YLydFzaM4Y>
3. Allen AM et al. (2012) Discovery and development of exome-based, co-dominant single nucleotide polymorphism markers in hexaploid wheat (*Triticum aestivum* L.). *Plant Biotechnol J* 11(3):279–295.
4. Summary statistics for the Axiom Wheat Breeder's Genotyping Array.
http://www.cerealsdb.uk.net/cerealgenomics/CerealsDB/axiom_mapped_snps.php
5. Search SNPs on the Axiom Wheat Breeder's Genotyping Array.
http://www.cerealsdb.uk.net/cerealgenomics/CerealsDB/axiom_35K_search.php

Ordering information

Product	Description	Cat. No.
Axiom Wheat Breeder's Genotyping Array	Contains one 384-array plate; reagents and GeneTitan Multi-Channel Instrument consumables sold separately	550524
Axiom GeneTitan Consumables Kit	Contains all GeneTitan Multi-Channel Instrument consumables required to process one Axiom array plate	902234
Axiom 2.0 Reagent Kit	Includes all reagents (except isopropanol) for processing 384 DNA samples	902245

Find out more at thermofisher.com/microarrays

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